THE MECHANISM OF OVIPOSITION IN PHÆNICIA (LUCILIA) SERICATA MEIG. (DIPTERA)

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Oviposition is a complex process involving a variety of factors. Some of the factors involve the physiology of the insect, some are external to it. All form a complex so involved that the process is difficult to control experimentally or even to evaluate from observation. In these respects oviposition differs from, let us say, the feeding response, which, although far from simple, may be experimentally controlled with some degree of success, and its characteristics predicted under known conditions with some degree of assurance.

In a living fly, dissected in Ringer's solution at room temperature, the ovaries may, and usually do, contract rhythmically. Contraction is fairly rapid, relaxation slow, and the intervals between beats are often decidedly unequal. Not only does the ovary as a whole pulsate, the individual ovarioles exhibit a periodic wave of contraction which passes from the free end of each toward the body of the ovary. There is no synchrony in this contraction, for each ovariole behaves independently in this respect, and indeed any synchrony between the contractions of the two ovaries appears to be accidental. These movements are doubtless responsible for the extrusion of ova which has been observed even in cases of organs completely excised.

Studies extending over a period of three years had as their object the determination of factors which influence ovarian pulsation. The evidence indicates that these are myogenic. Excised ovaries may pulsate for hours, even in the presence of nicotine, and there is no evidence that an eserine-acetylcholene solution has more than a slight effect upon pulsation. Indeed, after applying every possible type of stimulus, the conclusion was reached that only three are effective in increasing the rate and intensity of pulsation. These are: 1, mechanical, 2, osmotic, and 3, thermal.

Poking, pinching, or pushing an ovary which has ceased to pulsate will often initiate pulsation which, however, is generally of short duration when the mechanical stimulus alone is applied. The application of solid particles of NaCl, of sucrose, or of concentrated solutions of these, initiate pulsations which endure much longer than those initiated by mechanical stimuli.

But the most effective stimulus is that of *temperature.* On several occasions preparations, which had remained overnight, had cooled to a temperature of 10° C., and ceased to pulsate, resumed activity when the cold liquid was replaced by Ringer's warmed to a temperature of 25°–35° C. Moreover pulsation then continued for some time. Further observation demonstrated that gradual cooling of the fluid was accompanied by a decrease in the rate of ovarian pulsation. The table is composed of averages from several observations.

TABLE I

DECREASE IN OVARIAN PULSATION WITH DECREASE IN TEMPERATURE

Temperature, ° C.	Number of contractions per minute
35	8.1
34	6.0
33	5.4
32	4.5
30	4.3
28	4.2
27	4.0

Of and by themselves these observations indicate nothing concerning oviposition. But consider the following data taken from my notes.

Still not until I read in a paper by Shannon and Putnam (1934), that the oviposition rate of *Ædes ægypti* rises 7.7 per cent with each rise of 1° C., did the possibility occur to me that oviposition by *P. sericata* may *depend more upon certain external factors than upon nervous mechanisms in the insect.*

It has generally been assumed that oviposition by calliphorid flies is initiated by chemical and mechanical stimuli, the effects of which are immediate and essential. Now although oviposition generally occurs in the presence of "meat odors," and usually, too, when the insect is in direct mechanical contact with the meat, gravid females, confined in small containers (*e.g.*, a test tube), will deposit eggs, and when confined in a cage will likewise deposit eggs about their drinking fountain and dishes containing sugar.

Furthermore oviposition is closely associated with feeding. Detinova (1936) has observed that *Anopheles messeæ,* before ovipositing, probes the water with her proboscis. If the water contains materials which inhibit feeding, oviposition is likewise inhibited. Hecht (1930) found that optimum ovipositon in a given species of mosquito depends in part upon the temperature of the water where eggs will be laid.

Students are agreed that stimuli which initiate oviposition are many and seldom operate singly. Kuzina (1940) found this to be true of *Musca domestica.* Mackerras (1933) states that oviposition by calliphorid flies depends upon copulation. (It is a fact that every ovipositing fly which I have subsequently dissected has contained sperm.) Hobson (1937) mentions as stimuli necessary for oviposition the nutritive condition of the insect, chemical stimuli, and contact stimuli. Starved, gravid females begin to feed before they oviposit, and even replete flies, although they will oviposit in response to distance chemical stimuli, generally require direct contact with the substrate.

TABLE II

Effect of Temperature upon Oviposition of *P. sericata*

Temperature, ° C.	Average number of eggs per female
20	1 ± .0
22	7 ± 1
24	19.5 ± 2
26	38.2 ± 2
28	45.5 ± 3
30	68.5 ± 2
32	75.0 ± 4
34	67.0 ± 5
36	42.5 ± 2

Obviously not all of the factors mentioned are stimuli of a nervous type, and since even those that are, vary so in their effect, one is justified in suggesting that the act of oviposition *per se* involves a release mechanism. This is the more probable because observation demonstrates that the vagina is generally in a state of contraction.

There is a definite limit, however, to inhibitory action, whether at the site of the vagina or elsewhere. High temperatures, confinement, and repletion make retention of the ova practically impossible. It is attraction of the fly to animal matter—not a stimulus to oviposition—which accounts for the deposition of eggs upon flesh. This also explains the observations of Salt (1930) and Vladimirova and Smirnov (1938) that flies deposit more eggs upon the nutritive substrate than it will support as larvæ.

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